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Environmental Sensors based Occupancy Estimation in Buildings via IHMM-MLR

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Abstract:

Occupancy estimation in buildings can benefit various applications such as HVAC (Heating, Ventilation and Air-Conditioning) control, space monitoring and emergency evacuation. Due to the consideration of temporal dependency in occupancy data, Hidden Markov Model (HMM) has been shown to be effective in occupancy estimation. However, the conventional HMM that assumes invariant temporal dependency of occupancy dynamics for different time instances is unrealistic. Moreover, the performance of the conventional HMM that utilizes mixture of Gaussian for emission probability in terms of continuous observations can be easily affected by the noise in sensory data. To address these problems, in this talk, we introduce a new architecture, i.e. Inhomogeneous Hidden Markov Model with Multinomial Logistic Regression (IHMM-MLR), for building occupancy estimation using non-intrusive environmental sensors. Instead of using the time-invariant transition probability matrix, we apply a time-dependent (inhomogeneous) transition probability matrix which can capture the temporal dependency for different time instances. Meanwhile, we employ an efficient probabilistic model, i.e. MLR, for emission probability. Online and offline occupancy estimation schemes are presented for real-time and accurate long-term applications respectively. Real experiments have indicated the effectiveness of our proposed approach.

Biography:

Zhenghua Chen is currently a PhD candidate and project officer in the School of Electrical and Electronic Engineering at Nanyang Technological University (NTU), Singapore. He received his BSc in mechanical engineering from University of Electronic Science and Technology of China, Chengdu, China, in 2011. His current research interests are primarily in data analytics in smart building, more specifically, occupancy modeling, estimation and prediction; indoor localization; human activity recognition.